

16679

SUPERIOR TECHNOLOGY FOR A SUPERIOR ARMY

THE WORLD'S ULTIMATE WEAPON RUNS ON WATER...
EVERYTHING ELSE RUNS ON FUEL AND LUBES

- Army Fuels - Policies, Regulations and Executive Orders

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U.S. ARMY TANK AUTOMOTIVE RESEARCH DEVELOPMENT AND ENGINEERING CENTER

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Outline

- Executive Orders
 - Purpose
 - Impact on Tactical/Combat equipment
- Key Army Documents
 - Army Regulation 70-12
 - Key information
 - DOD Directive 4140
 - Purpose and key information
- Comparisons of Fuels
 - Approved Fuels
 - Synthetic Fuels
 - Biodiesel
- What TARDEC POL is doing to reduce fuel consumption and petroleum dependence

Executive Orders

- EO 13031 – Federal Alternative Vehicle Leadership
 - To improve fleet fuel efficiency and use of alternative fuel vehicles and alternative fuels
 - Exemptions – DOD military tactical vehicles are exempt from this order
- TARDEC has active programs looking at Fuel Cells and Synthetic Fuels.

Executive Orders (cont'd)

- EO 13149 – Greening the Government through Federal Fleet and Transportation Efficiency
 - Revokes EO 13031
 - Same Goals and objectives of EO 13031 however, includes requirements for petroleum displacement and use of alternative fuels
 - Agencies can no purchase virgin oil if environmentally preferable alternative is available
 - Exemptions - DOD military tactical vehicles are exempt from this order

Executive Orders (cont'd)

- Installations eager to include tactical vehicles due to need for “Energy Credits”
- No restrictions in use of alternative fuels in non-tactical vehicles/equipment
 - May not gain enough credits
 - Can jeopardize readiness if non-certified products are used
 - Commercial utilization does not mean military approval

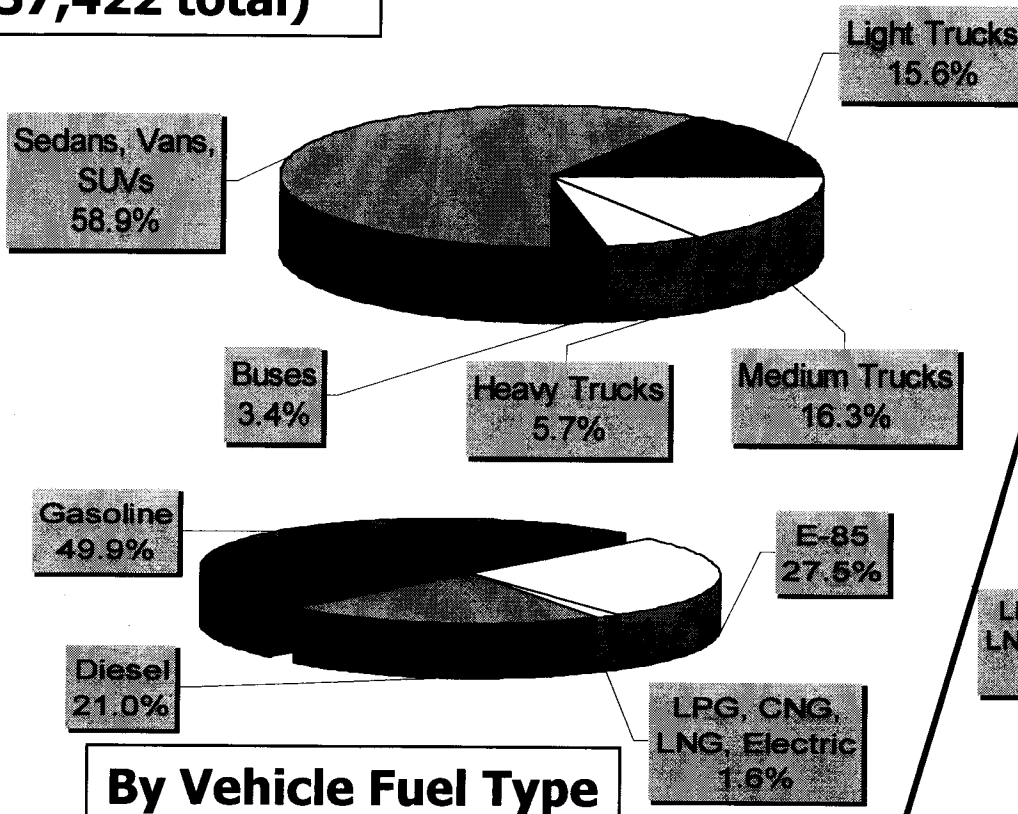
Alternative Fuels Used

- Under previous discussed EO most common alternative fuels are:
 - B20 – 80% diesel 20% biodiesel
 - E85 – 85% ethanol and 15% gasoline.
- These are but two alternative fuels utilized by NTV.
- Biodiesel is acceptable for commercial applications due to its high turnover rate.
 - No diesel engine modification required
- E85 can only be used in flex-fuel vehicles
 - Gasoline type vehicles only
 - Requires special considerations for corrosion

Fuel Use in NTV Fleets

(2005 Federal Fleet Report, Government Services Administration)

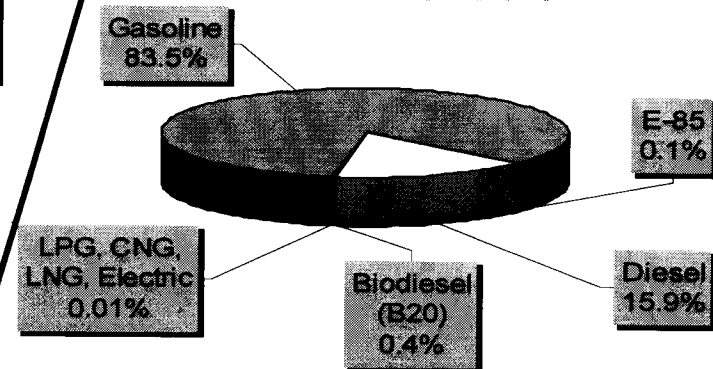
By Type of Vehicle (57,422 total)



* Data shown for worldwide profile; about 93% of fleet is domestic.

Fleet Fuel Use*

- Under EPA Act, E.O. 13149, NTV fleets operating in U.S. must increase use of non-petroleum based fuels
- On-going efforts to add refueling stations for alternative fuels



By Type of Fuel** (51 M gal total)

** All data in gasoline gallon equivalents (GGE).

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Key Army Documents

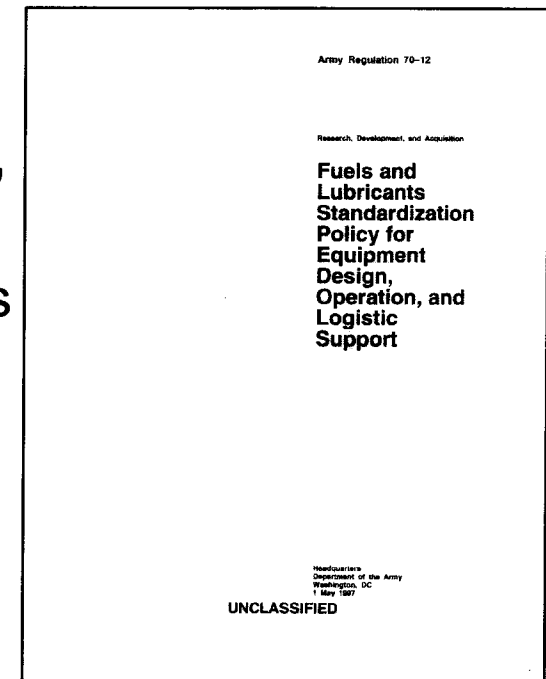
- Army has two documents that deal with policy regarding:
 - Standardization of POL products used
 - ID who is responsible
 - Implementation of the Single Fuel in the Battlefield
 - Directs no equipment procurement that cannot use standard fuels adopted by Army

AR 70-12 (cont'd)

- Responsibilities:
 - ASA/RDA – ensure new material development embodies the SFB and minimizing number of fuels in the battlefield.
 - DCSLOG – establishes Army policy
 - AMC – establishes policy for RDTE, procurement, modification, of equipment and Material that uses fuels and lubes.
 - Chief Engineers – fixed facilities
 - TARDEC - execute RDT&E and DOD EA for the POL products used in ground equipment & evaluation of aftermarket additives
 - Army Petroleum Center –all service item control center functions for POL
 - TACOM LCMC– petroleum distribution systems and equipment


AR 70-12

- Fuels and Lubricants Standardization Policy for Equipment Design, Operation, and Logistic Support
 - Consolidates the responsibilities and policies for fuels, lubricants and associated products utilization and standardization for all Army agencies.
 - Includes the Army Fuel policy and related definitions
 - Identifies the standardization policy on using lubricants, fluids and associated products.
 - Identifies the policy governing the use of proprietary and lubricant aftermarket additives



DOD 4140.25

- DOD Management Policy for Energy Commodities and Related Services
 - Minimize the number and complexity of fuels required, and maximize the use of commercial fuels.
 - Fuel Standardization "...Primary fuel support for land-based air and ground forces in all theatre (overseas & in CONUS) shall be accomplished using a single kerosene-based fuel, in order or precedence : JP-8, commercial jet fuel (with additive package), or commercial jet fuel (without additives), as approved by the Combatant Commander. Fuel..."

	Department of Defense DIRECTIVE
	NUMBER 4140.25 April 12, 2004
USD(AT&L)	
SUBJECT: DoD Management Policy for Energy Commodities and Related Services	
References: (a) DoD Directive 4140.25, same subject as above, August 25, 2003(hereby canceled)	
(b) DoD 4140.25-M, "DoD Management of Bulk Petroleum Products, Natural Gas, and Coal," current edition	
(c) DoD 5025.1-M, "DoD Directives System Procedures," March 5, 2003	
(d) DoD Directive 3110.6, "War Reserve Material Policy," November 9, 2000	
(e) Executive Order 12919, "Priorities and Allocation," June 3, 1994	
(f) DoD Directive 5530.3, "International Agreements," June 11, 1987	
1. REISSUANCE AND PURPOSE	
This Directive reissues reference (a) to update policy and responsibilities to:	
1.1. Manage energy commodities (i.e., petroleum, natural gas, coal, electricity, steam, propellants, chemicals, pure gases, and cryogenic fluids), quality assurance and quality surveillance, storage, and associated facilities.	
1.2. Minimize the number and complexity of fuels required, and maximize the use of commercial fuels.	
1.3. Continue authorization to publish reference (b) and other DoD Publications on the subject of energy commodities, consistent with reference (c).	

Summary Army requirements

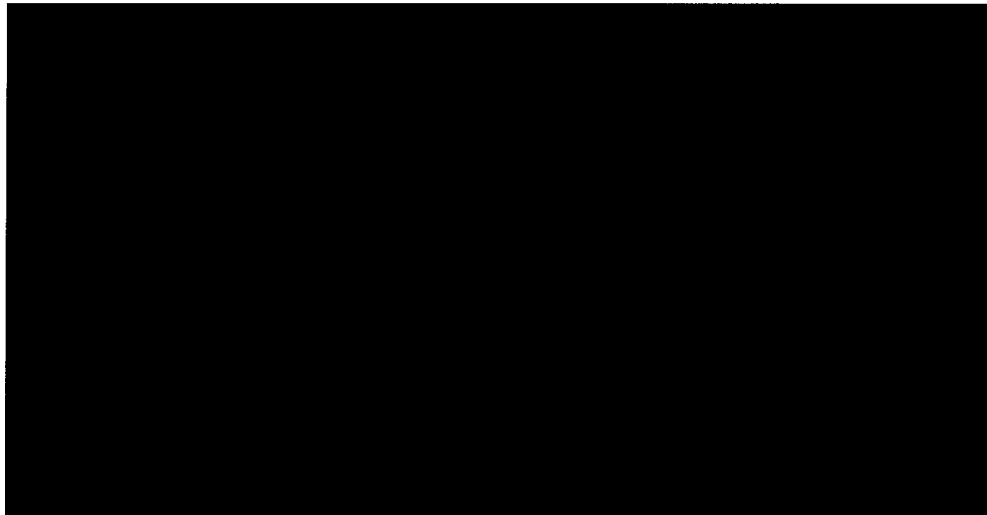
- Army recognizes need for standardization of POL products that support equipment and minimize logistic tail.
- Implemented JP-8 as main fuel.
 - Train as you will fight supports use of JP-8 in CONUS
- Equipment has to be designed in accordance with this policy - SFB.

Comparison of Alternative fuels

- Kerosene Base
 - Synthetic Fuel (Fischer-Troupsh)
 - JP-8
 - Commercial jet fuels Jet A-1
 - JP-5
- Diesel/Middle distillate fuels
 - Diesel Fuel
 - Synthetic diesel

DOD Key Fuels & Specifications

Single Fuel in the Battlefield



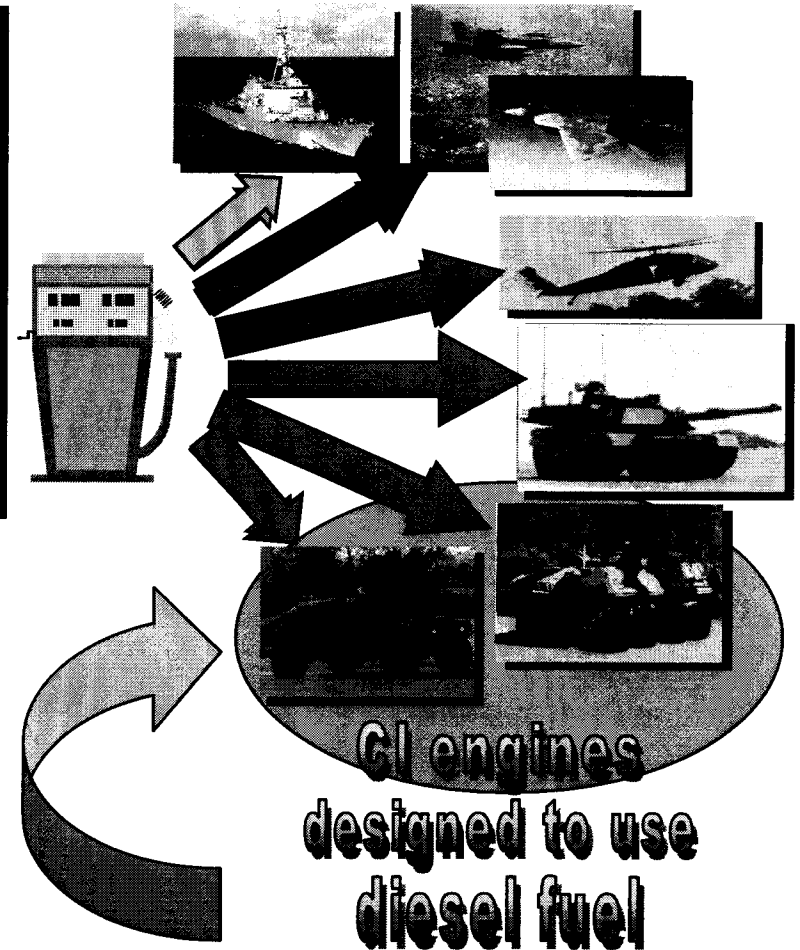
Commercial & Other Military Fuel

Diesel fuels

- No. 2-D and No. 1-D
- A-A-52557 (C/D)
- ASTM D 675

*Commercial Item Description

End-uses in DoD fleets



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Kerosene base fuels

- JP-8, Jet A-1 & JP-5 are essentially the same.
 - JP-8 & JP-5 require additive treatment
 - Flash point (JP-5 has a high flash requirement)
 - JP-5 meets JP-8 requirements
- FT jet fuels almost identical to JP-8/JP-5/Jet A-1
 - FT differences
 - Zero aromatics
 - Zero sulfur
 - Slight lower density, as low as 0.750 vs 0.775 min for JP-8.
 - High Cetane No. >58 vs cetane index 40 mean JP-8

FT Differences

- Zero Aromatics
 - Concern with elastomer reaction and potential fuel leakage
 - Older equipment/components more at risk
 - Initial blends up to 50/50 eliminates concerns
 - More environmentally friendly fuel
- Zero sulfur
 - Concern with lubricity as sulfur distantly associated with lubricity.
 - Use of CI/LI would mitigate this impact.
 - Great for reduced SO_x and Particulate Matter (PM)

FT Differences (cont'd)

- Lower density
 - Impact still being investigated
 - FT has higher gravimetric energy (good for aircraft), slightly lower volumetric energy (less range for ground vehicles) but not a factor in blends
- Higher Cetane No.
 - Good property for ground vehicles, as it improves cetane in blends
 - Concern with 100% FT impact on ignition delay – may start combustion too soon

Middle Distillates

- Previous discussions still apply
 - FT Cetane No. closer to 70
 - Low temperature properties appropriate for diesel fuels
- Next provides the variety of papers published on FT fuels evaluation

- American Chemical Society
- 2003: “*Ab Initio* Study of Interaction of a Model Nitrile Polymer with Various Model Fuel Molecules” (R.A. Glenn Award Nomination)
- 2004: DoD organized & chaired session on FT Jet Fuels at Jet Fuels Symposium
 - “Production and Characterization of Synthetic Jet Fuel Produced from Fischer-Tropsch Hydrocarbons”
 - “Composition of Syntroleum S-5 and Conformance to JP-5 Specification”
 - “Evaluation of Fischer-Tropsch Synthetic Fuels for United States Naval Applications”
 - “Separation and Identification of Oxygenates as Suspected Performance-Enhancers for Synthetic Jet Fuels”
 - “The Swelling of Selected O-ring Materials in Jet Propulsion and Fischer-Tropsch Fuels”
- 2005: “Reduction of Turbine Engine Particulate Emissions Using Synthetic Jet Fuel”
- Society of Automotive Engineers
- 2004: “Alternative Fuels: Assessment of Fischer-Tropsch Fuel for Military Use in 6.5L Diesel Engine” (selected for *SAE Transactions*)
- 2005: “Fischer-Tropsch Fuels: Why Are They of Interest to the United States Military?”, “Bench-top Lubricity Evaluator Correlation with Military Rotary Fuel Injection Pump Test Rig”
- 2006: “Properties of Fischer-Tropsch (FT) Blends for Use in Military Equipment”
- 2007 to be published: “The Effects of Switch-Loading Fuels on Fuel-Wetted Elastomers”

American Institute of Aeronautics and Astronautics

- 2004: “Fischer-Tropsch Jet Fuels – Characterization for Advanced Aerospace Applications”

POL efforts to reduce Fuel Consumption & Petro Dependence

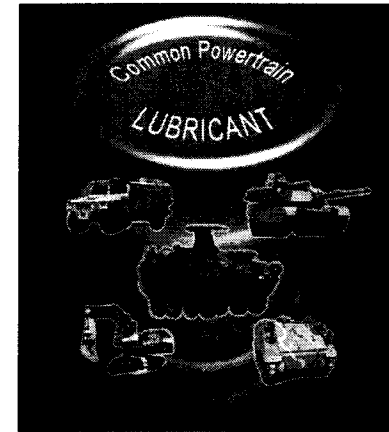
- Synthetic Lubricants Evaluation
 - Evaluate synthetic lubes to reduce maintenance burden & improve MPG
- Single Lubricant Effort
 - Reduce number of products/grades required
- Nanofluids/lubricants
 - Application of nanoadditive products
 - Wide range of application to powertrain products
 - Include potential to improve coolants heat rejection

Synthetic Lubricants evaluation

- Partnered with Industry to develop data
 - Conducting durability tests to assess drain interval improvement
 - Pre and post components/parts evaluation and oil analysis
 - Engine test conducted by SwRi
 - Conducting transmission efficiency studies
 - Assess compounding benefits to reduce fuel consumption by using product in transmissions
 - No load spin loss test conducted by TARDEC
 - Economic Analysis will utilize cost of product and % improvements results to determine payback period.

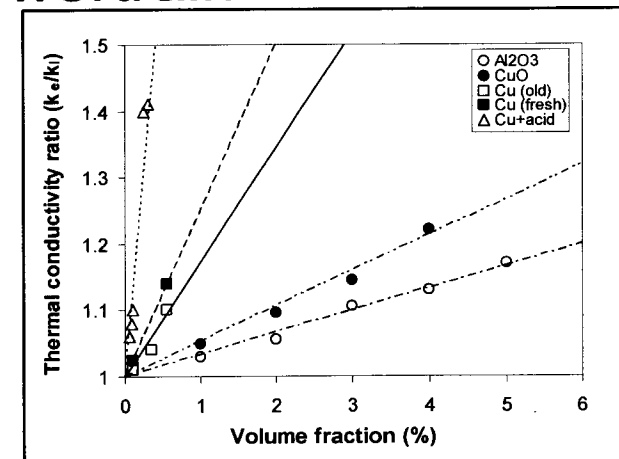
Single Lubricant

- Reduce No. of products/grades from 8 to 1
 - Arctic to Desert operations
 - Lower viscosity oil improves fuel economy
 - Ability to withstand OIF temps
 - Maintain multi-component capabilities
 - Include Preservation requirements
 - Reduce logistic tail, inventory, documentation, and cataloging for POL used in vehicles/equipment
- Performance promotes the use of Synthetics
- FT potential candidate?

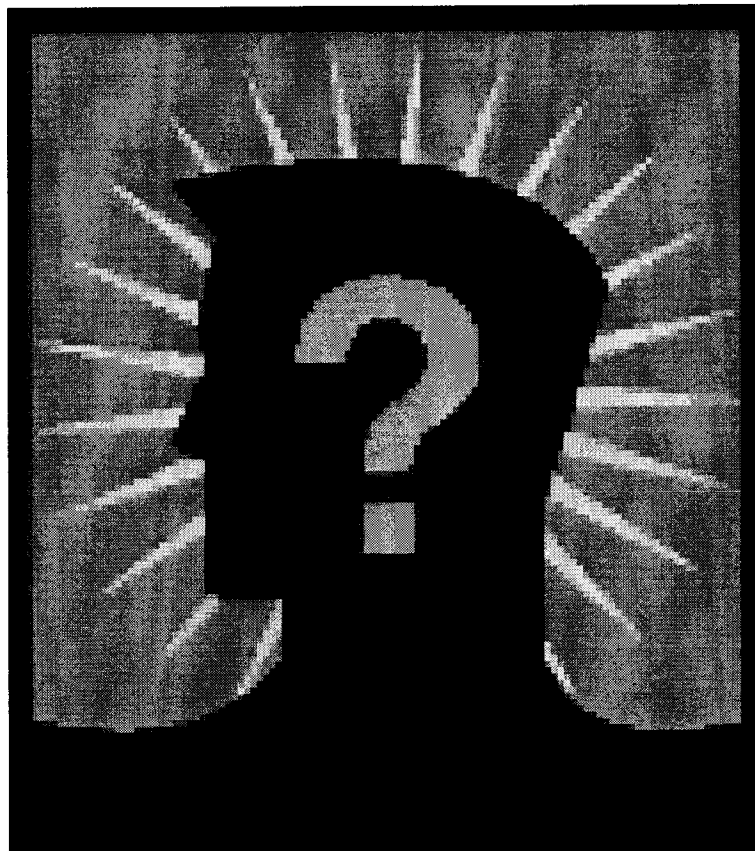


Nano-fluids/lubricants

- New technology area
- Potential to impact all products in powertrain
- Looking for benefits
 - Reduced fuel consumption
 - Reduced wear
 - Improved heat transfer
 - Better heat resistance
 - Improved fuel lubricity?
- Area potential over above desired benefits
 - “Intelligent” particles
 - Activate as needed
- Currently seed funds from Congressional Plus-up



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